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# CHOLERA

AND

ITS FOSTERING CONDITIONS  
WITHIN THE ENDEMIC AREA.

BY

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*Read at the Annual Meeting of the British Medical Association,  
held at Glasgow, August, 1888, by J. Christie, M.D.,  
Vice-President, Public Health Section.*

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## CHOLERA AND ITS FOSTERING CONDITIONS WITHIN THE ENDEMIC AREA.\*

By W. J. SIMPSON, M.D.,  
Medical Officer of Health, Calcutta.

IN responding to the request of the Secretary to prepare a paper on cholera, as prevalent in Calcutta and its surrounding districts, I shall not enter into the controversies connected with Dr. Koch's comma bacillus; for, apart from the valuable researches of Dr. D. D. Cunningham, scientific enquiries on this subject are not carried on in India. The relative importance to be attached to the comma bacillus, or any other micro-organisms discovered in cholera or other diseases, must, as matters now stand, be determined in Europe and America by trained scientists working in well-equipped laboratories. Not that there is any lack of talent of the best kind for such investigations among the medical men of the Indian Army, nor any lack of material in India awaiting patient research. Diseases of man and beast are to be found in abundance. Leprosy, cholera, fevers, tetanus, diabetes, cerebro-spinal fever, glanders, anthrax, and cattle plague, are common enough; but organisation, laboratories, and apparatus are wanting. Before any real progress in scientific medicine can be accomplished in India, the scientific branch of the medical service must be distinct from the administrative; for administrative functions preponderating, relegate the scientific to such a position as to render it impossible to carry on to any advantage research requiring much labour, time, and thought. What is required is a central institute, well equipped, and having attached to it a body of men well trained in the chemical, physiological, and biological methods of the day, and who shall devote their whole time to teaching, and to the systematic pursuit of scientific research.

Into the natural history of the *materies morbi* of cholera it would, therefore, be useless to enter; but whatever doubts may be entertained as to the exact nature of the cholera virus, the fostering conditions which allow the disease to smoulder on during the cold weather, and which year after year, at certain seasons, are the chief agents in affecting its

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rapid spread, are apparent enough, both in Calcutta and its neighbourhood. Calcutta, with a population of 450,000, is situated on the east bank of the Hooghly. It is connected by a bridge with the town of Howrah, which is situated on the western bank of the river, and contains about 100,000 inhabitants. Calcutta extends along the river side for about five or six miles, and is about a mile and a half in width. It is separated from its eastern suburbs by a ditch, made at one time to protect the community against the incursion of the Mahrattas; about two or three miles east of this ditch is a salt marsh.

Like other eastern towns on the deltas of great rivers, the natural drainage of Calcutta is away from the river towards the marsh. Accordingly the main line of drainage is now in this direction, the main sewers being so laid as to discharge their contents into an intercepting sewer parallel with the Mahratta ditch. The intercepting sewer terminates in a pumping station which, by means of a high level sewer, discharges the sewage, at some distance from the town, into an open canal which communicates with the salt water lake, which in turn is connected, by numerous creeks and khals, with the sea. The sewage is believed to find its way ultimately to the sea.

The east wind is fortunately not a prevalent one in Calcutta, but when it does blow for a few days in the hot season the atmosphere of the town is tainted with most offensive odours. The nearer to the lake the inhabitants dwell, the more prone are they to suffer from fever which is occasionally of a very malignant type, especially among Europeans and new-comers, though the general type of the fever appears not to be so severe as it was in the early part of the century.

It is recorded that in 1803 or 1804 the Marquis of Wellesley directed a vigilant watch to be kept at Balliaghatta, on the edge of the marsh, for some French deserters who were supposed to have fled by water in that direction. A police special guard of 12 men was sent out and stationed there. After four days it was reported to the magistrate that all but three of them were dangerously ill; two were brought to Calcutta in the height of delirium with yellow bilious fever. The guard was relieved, and the following week all of the new guard were attacked by the fever. In less than two weeks, out of 24 men 6 died. During the past 50 years the drainage of this lake has at intervals of time been considered. The schemes, however, up till now have not taken practical shape. Some day, perhaps, a Company, such as the Aboukir Reclama-

tion Company in Egypt, will take in hand the drainage of the lake, and by its operations acquire a large extent of arable land, and rid Calcutta and its suburbs of the fever attributable to this marsh.

The town of Howrah shelves from the river in a westerly direction, and is bounded by rice fields and fresh water marshes. Fevers prevail towards the rice fields. The town has a system of surface drainage, being in this respect better off than the suburbs of Calcutta, which, excepting a few special localities, is undrained; it is also superior in its conservancy arrangements. The night soil in both districts is disposed of in trenches. The conversion into Poudrette would probably be a more advantageous and sanitary mode of disposal. Neither Howrah, with its 100,000 inhabitants, nor the suburbs of Calcutta, with its 250,000, have any public water supply other than the tanks which I shall describe later on. The Europeans, however, of whom there are a considerable number in Howrah (because of the construction of immense railway works, and a number of large mills), obtain their drinking water from Calcutta by water carriers. In fact, for miles round Calcutta very few of the better class Europeans will drink any other water than that brought from Calcutta. The same remark applies to many of the wealthier natives, but the community at large in Howrah and the suburbs have to obtain their water from pools. The insanitary condition of Howrah, without a public water supply, and without building regulations, is only surpassed by the suburbs, which have no public water supply, no drainage, no building regulations, nor any effective conservancy arrangements.

Seen from the river, Calcutta has a magnificent appearance. The fort, covering an area of three-quarters of a mile, occupies a prominent position, its eastern ramparts being close to and facing the river, while it has an extensive open park on its other three sides. The Government buildings north of the fort, the large mercantile houses in the European business quarter, the immense works and jetties all along the banks of the river carried out by the European Port Commissioners, the number of large ships from different parts of the world lying at anchorage in one of the noblest of rivers, impress one with a sense of the greatness of the city, and the vast amount of energy and money which has been spent in converting the English factory, founded by Mr. Job Charnock, the Company's Agent to India, in 1690, into the present thriving metropolis of India. The same indomitable energy, carrying out the western ideas of space and grandeur, is to be seen in the style



in which the European residential and business portion of the town is laid out. To the south of the native town it is well built with wide and straight streets, with large houses and gardens attached; it has a fairly liberal supply of excellent water, is well drained and fairly well cleansed, and in sanitation compares very favourably with the better parts of London. But cleanliness, regularity of streets, and other ordinary health conditions, serve only to accentuate the worse than medieval condition of a large portion of the native town. The contrast is almost inconceivable to those who have not seen it. With a few notable exceptions, northern and native Calcutta has narrow, irregular, and badly ventilated streets and lanes, which are often densely crowded with houses and huts built on irregular lines, and which, by reason of this irregularity, are badly and inefficiently drained. Only the better and middle class have a fair supply of water, while the poorer class get a very scanty supply, and resort to the numerous polluted ponds in their midst, in which they bathe, wash their rice domestic utensils and clothes. The native town is studded with wells from which the inhabitants draw water. The atmosphere, in the most crowded districts, is extremely offensive, owing to stagnancy of air in the ill-ventilated streets, the foul condition of the drainage, and bad conservancy.

One of the most remarkable physical features in Calcutta, its suburbs, and the town of Howrah, is the number of ponds. The suburbs are studded with them, large and small, and so is Howrah, but to a less degree. Calcutta has over 300 tanks, and formerly had more than treble that number; but since Surgeon-General Payne's tenure of office in 1877, as Health Officer, great activity has been displayed in filling up these tanks. But, in depriving the inhabitants of the use of the water in the tanks, no compensating supply of pure water has been given, consequently the benefits to be obtained from this measure have been very considerably nullified. The inhabitants, in earlier times, dug tanks to obtain earth to form a foundation to raise their huts upon, to furnish mud for the walls of their huts, and to drain the land, the ponds supplying an easy method of disposal of their drainage. As the population increased, some of the largest and best tanks were set aside for the supply of drinking water, and it became a meritorious act on the part of any rich and devout Hindoo to construct a large tank for the use of his own family and his neighbours. The situation of Calcutta and its neighbourhood, within the tropics and on an alluvial soil, combined with its

nearness to the sea, its low and level surface, its heavy sub-tropical rains, and its peculiar physical features, including ponds, lakes, khals, rivers, &c., give to the atmosphere of the district a humidity singularly favourable to the luxuriant growth of vegetation, the development of insect life, and of the lower forms of organisms. Wherever the air is stagnant, it contains abundance of germ life. The personal habits of the people are cleanly and all that could be desired. As a religious duty, they bathe at least once a day. The women generally bathe much more frequently. At all times during the day men and women are to be seen bathing in the river Hooghly, or in the tanks near to their houses or huts. But while full of solicitude for the purification of their persons, they are not sensible of the defilement to which they subject the unchanged water of their tanks, which become defiled by the excretions of the bather's body, by the washing of dirty clothes, frequently of clothes soiled by the excretions of the sick; at times, directly by human ordure, due to the practice of children and others defacating on the banks of the tanks, and nearly always by the sulliage and drainage from the surrounding huts and houses. Thus the water, except during the rainy season, varies in quality between the range of fairly good drinking water and that of concentrated sewage. The range is shown in the following analyses of samples; the first analysis is of water from a protected tank in which no bathing, washing of clothes, or pollution by drainage, is permitted; the next two are from tanks in the Native town; the fourth is the water as supplied to Calcutta, taken from the Hooghly, twenty miles above the town, filtered there, and conveyed to Calcutta in iron pipes, and distributed to the different quarters of the town.

	Chlorine.	Ammonia.		
		Free.	Albu- minoid.	Total.
Maidan tank, . . . . .	20	0.06	0.09	0.15
Two tanks in Native town, . . . . .	91	1.00	1.92	2.92
	318	32.00	35.08	67.08
Calcutta hydrant water, . . . . .	4.9	0.00	0.02	0.02

As an example of the condition of some of these tanks in one of the Calcutta bustees I give some notes taken at the time of my visit. The visit was made during the hot season,

when cholera is usually severely prevalent. "March 31st, 1888, water in tank quite low, would be lower in level if not fed by the drainage of a mill—colour, dirty green, consistence like pea-soup. Portions of crude disintegrated fecal matter floating on surface on north side; a thick greenish seum on the south side. Two cloths soiled with excreta lie soaking in the water; several deposits of human excreta on the sides of the tank near the water's edge; men and women bathing in the water. Other women are cleansing their household utensils in the tank, several are washing dirty linen while others are drawing water and taking it away in earthen vessels or chatties. While making these notes a girl comes direct from a privy, close by, enters the tank and quickly performs her ablutions.

"Second tank in same bustee has completely dried up. Some of the inhabitants who are erecting huts are digging mud from the bottom of the tank to use for the walls of their huts. The holes thus formed still contain some foul and offensive water which is being used for washing utensils, &c. Embedded in the mud of the tank are tin boxes, broken chatties, and refuse of all kinds. The tank has been dry for 10 or 12 days, and since that time has been used as a convenient place for drying cowdung cakes; heaps of cowdung have been collected on the bank for that purpose. It was also used as a receptacle for the refuse of the neighbouring huts. This was a bustee into which cholera had been introduced from another quarter of the town and had rapidly spread. As a general rule it may be stated that though the desire for personal cleanliness is universal, being insisted on as a religious duty, the anxiety for cleanly surroundings is an exception. The most odious sights around the dwelling are viewed with unconcern."

Now that the general physical features of the district have been described and those habits influencing the conditions of cleanliness of water, air, and soil have been noticed, the relations these bear to the prevalence of cholera may now be considered.

First of all, as regards the defilement of the tanks, the prevalence of cholera in any special district has long been looked upon as owing its chief cause to the polluted tanks, but in the suburbs, where so many tanks exist, the fact that cholera cases occurred near tanks was not very conclusive; for it would be difficult to find houses not near tanks; but Dr. Payne and Dr. Macleod showed that, for Calcutta at all events, wherever cholera was prevailing in huts near tanks, the emptying of the suspected tank, or the simple guarding of it, so that the water



was not used, was immediately followed by abatement, very often by complete cessation, of the disease. Instances also occasionally came under observation where a small district, whose inhabitants are accustomed to go to one tank, has been free for years from cholera, but which is suddenly affected with the disease; and inquiry elicits the fact that a patient suffering from cholera has been brought from some other locality to a hut on the borders of the tank, in which either the soiled clothes of the patient have been washed, or into which the drainage of the infected hut flows.

In one ward in Calcutta, containing nearly 25,000 inhabitants, out of 111 deaths from cholera inquired into, 66, or 59 per cent, were close to tanks. It has also been observed that bustees which used to be notable for being scarcely two successive years without many deaths from cholera have, since the tanks have been filled up, escaped to a very great extent. This is adverse to the view that the soil has a preponderating influence in the dissemination of cholera. In Calcutta, undoubtedly, there are localities in which cholera and fever prevail extensively together; there are, however, other localities in the town in which the inhabitants suffer from fever but in which cholera is rare. The two diseases may exist together in a locality, but that cholera is miasmatic in its general mode of spread, is not supported by the evidence of its general behaviour in Calcutta. At the same time, it may be stated that, in the process of filling up tanks with refuse, and even after the filling up, on the setting in of the rains the tanks for the first year or two are apt to give forth offensive odours, and it has been noted that the inmates of the neighbouring houses suffer from choleraic symptoms. Lately a recently filled up tank had its refuse upturned to ascertain what amount of earth had been mixed with the refuse. During the examination, five of the members of a family living in a house on the windward side of the tank were attacked with vomiting and purging. In fact, the alluvial soil of Calcutta, *per se*, does not seem to be able to generate the cholera poison any more than tank water until specifically polluted.

The contrast between the sanitary condition of the European quarter and the native town, is not more striking than the contrast between the ratios of cholera prevalence in the two localities. During the two years that I have been in Calcutta, there has not been a single death among the European residents in the Park Street ward, which is the best kept ward in the town. During the two years, there have been

several exacerbations or epidemics of cholera in Calcutta. The most intense was during October, November, and December of 1886. The weekly deaths from cholera were as follows:—

Week ending October	8,	34 deaths.	Week ending December	5,	107 deaths.
„	„	15, 98 „	„	„	12, 94 „
„	„	22, 63 „	„	„	19, 63 „
„	„	29, 73 „	„	„	26, 49 „
„	November 5,	54 „	„	January 2,	31 „
„	„	12, 67 „			
„	„	19, 88 „			
„	„	26, 117 „		Total,	938 „

Throughout the whole of this quarter, cholera prevailed in Calcutta to an extent quite unexampled at that season of the year for at least 18 years past. Yet not a single European was affected, nor was a single native resident or servant in Park Street ward taken ill. At the commencement, between the 8th and 15th of October, four native servants died, but they were shown to have been infected elsewhere. It is at least a most remarkable fact that 5,000 persons should dwell in what has been termed the home of cholera, and should have cholera prevailing all round them (for the epidemic was as severe in the town of Howrah and the suburbs as it was in Calcutta), and yet that the 5,000 should escape. On the other hand, some of the native wards registered during the quarter a cholera death-rate of 10, 11, and 12 per 1,000 of the population. Europeans in Calcutta sometimes are affected, but in the few instances I have been able with any degree of success to follow out, it has been ascertained that either the cook's family had cholera, or that the milk drank was brought from an infected locality. In one instance in which cholera was introduced into a sisterhood, attacking two ladies out of four residents in the house, it was discovered that the cook's wife and children were ill with cholera, and that he was accustomed to go backwards and forwards several times a day between his home in the bustee where he nursed his family, and the sisterhood where he prepared the food for the four sisters. A curious outbreak in a large Roman Catholic Home may be mentioned. The young children of the Home occupied an upper storied room, which was apart from the main building containing the adult inmates. Six of the eleven children were suddenly affected with what appeared to be cholera. Three of them died. None of the adults or sisters were taken ill. There had been no cholera in or near the district for some time. The cows were kept on the premises. Here it was suspected that the gowala who had been dismissed and for-

bidden the premises, but who, notwithstanding, had been seen in the gowala shed some days before the outbreak, had done something to the milk or to the cows; for it was noticed at the same time as the outbreak happened among the children that all the young calves were suffering, and were so weak as to be hardly able to stand.

Occasionally isolated cases of sporadic cholera appear among Europeans and Eurasians; but careful enquiry usually shows that their cause is to be sought in some form of decomposed food which the patients have partaken of. Dr. McLeod, whose experience of Calcutta extends over seventeen years, has frequently met with cases resembling cholera caused by the ingestion of sausages, fish, or meat in a putrid condition. These are cases of ptomaine poisoning, and are quite distinct from ordinary cholera. But not more remarkable than the immunity of the European quarter of the town, or the relative lower cholera death-rate which South Calcutta enjoys compared to North Calcutta, is the relative position that Calcutta as a city holds to Howrah and the suburbs as regards cholera prevalence. Subjoined is a tabular statement of the cholera death-rate in the town of Howrah, suburbs, and Calcutta, from 1871. There was no registration of deaths in Howrah in 1871 and 1872, nor in the suburbs for 1871.

YEARS.	TOWN OF HOWRAH.		SUBURBS.		CALCUTTA.	
	No. of Deaths.	Death-rate.	No. of Deaths.	Death-rate.	No. of Deaths.	Death-rate.
1871	...	...	...	...	1st Period.	796
1872	...	...	1,084	4.3		1,102
1873	458	5.0	1,768	7.0		1,105
1874	*759	8.3	2,038	8.1		1,245
1875	578	6.3	2,316	9.2		1,674
1876	512	5.6	2,316	9.2		1,851
1877	437	4.3	1,908	7.5		1,418
1878	615	6.7	2,363	9.3		1,338
1879	397	4.3	1,870	7.4		1,186
1880	218	2.3	980	3.5		805
1881	489	5.3	1,879	7.4	2nd Period.	1,693
1882	668	7.3	2,349	9.3		2,240
1883	556	6.1	2,132	8.4		2,037
1884	*707	7.7	2,421	9.6		2,272
1885	372	4.0	1,877	7.4		1,603
1886	528	5.8	1,844	7.3		1,741
1887	273	3.0	2,090	8.3		1,198
						2.7

\* High.

The difference will be observed to be considerable. In the several years there is, as in other epidemic diseases, a certain fluctuation; but the main facts shown by this table are that, for the period between 1870 and 1880, the suburbs had three times and Howrah twice the cholera death-rate of Calcutta, and this though Calcutta has nearly twice the population of the suburbs, and over four times that of Howrah; while between 1881 and 1886—especially during the years 1882, 1883, and 1884—there was a higher cholera prevalence in Calcutta, which was not shared in to a corresponding degree by the suburbs or the town of Howrah. This lessened the very favourable comparison which has just been drawn for the first period between Calcutta and the two districts which surround it; but notwithstanding this, Calcutta had, during the second period, only about half the cholera death-rate of the suburbs, and only two-thirds that of Howrah. In 1887 the suburbs had proportionally three times the number of deaths from cholera as compared with Calcutta.

A former Sanitary Commissioner for Bengal stated to me his opinion, based on a thorough knowledge of Bengal, that no other locality in the province presents such a terrible state of insanitation as the suburbs of Calcutta. It would, at all events, be difficult to conceive anything worse. The history of cholera in Calcutta is an instructive one. In 1870, works, which had been projected for several years previously, were completed; the drainage of the European portion of the town was laid down; and a splendid water supply was introduced. The practice of throwing night soil into the river ceased, and the garbage and refuse of the town were taken to the salt water lakes, and used for cultivating grass.

Coincidentally with these sanitary improvements an unprecedented change took place in the degree of prevalence of cholera in Calcutta. Before 1870 the average number of cholera deaths was 4,000 per annum, varying considerably in different years. In some years there were 5,000 or 6,000 deaths; in other years the mortality dropped down to 2,000, according as the climatic conditions were favourable or the reverse. But in 1870 the numbers ran down to 1,558, and, as will be seen from the following table, remained below 2,000 a year for 12 years, varying from 1,850 to 800, instead of from 6,000 to 2,000:—



Cholera.			Cholera.			Cholera.			Cholera.		
Year.	Deaths.	Ratio.	Year.	Deaths.	Ratio.	Year.	Deaths.	Ratio.	Year.	Deaths.	Ratio.
1866	6,826	15·7	1871	796	1·8	1876	1,851	4·2	1881	1,693	3·9
1867	2,270	5·2	1872	1,102	2·5	1877	1,418	3·2	1882	2,240	5·1
1868	4,186	9·6	1873	1,105	2·5	1878	1,338	3·0	1883	2,037	4·7
1869	3,582	8·2	1874	1,245	2·8	1879	1,186	2·7	1884	2,272	5·2
1870	1,558	3·5	1875	1,674	3·8	1880	805	1·8	1885	1,603	3·7
	18,422	8·5		5,922	2·7		6,598	3·0		9,845	4·5
1886	.	.	.	.	.	.	.	.	.	1,741	4·0
1887	.	.	.	.	.	.	.	.	.	1,198	2·7

Then a new era seems to have set in, for in 1882 the mortality rose above 2,000, continued so for three years, and remained high until last year, when the mortality fell to its former level. It is worthy of note here, that at the time of the rise of cholera in Calcutta, certain works, which were being constructed at the outfall sewer, prevented the sewers from being flushed, and there were general complaints of the stench arising from them; while the network of underground drainage of the northern portion of the town added its part to the pollution of the air. Perhaps a more important factor still was the great scarcity of water that characterised the districts where cholera prevailed most. Originally the filtered water was a constant supply when only supplying the stand-posts in the street, a few of the more important tanks and the house connections of the European community, and of some of the more wealthy natives. The demand, however, for house connections soon became so numerous as to gradually necessitate an intermittent system. Even in 1872 schemes were considered for a larger supply, but it was only in 1886 that partial relief was obtained. In the meantime unlimited waste and rapid increase of house connections had brought some parts of the town to such a pass that, even with more water being pumped from the river, certain localities were often without water, and the whole town suffered more or less. The present position is that the rich and middle classes get more water than they ever had, while the poor generally are worse off than when the supply was first introduced; and it is precisely amongst the latter class, and where the water is scantiest, that cholera now prevails. In an investigation made into more than 1,800 cholera cases, the proportion of

deaths in hut and brick-built houses was found to be over 3 to 1, though the population in hut and brick building is about the same in numbers. Only 6 per cent of the cholera cases occurred in houses provided with tap water, and these, for the most part, in localities exceptionally crowded, densely built over, and filthy.

The sudden change in 1870 in the cholera mortality, appears to have been peculiar to Calcutta, so far as general evidence can be relied on; but as mentioned previously, statistics for Howrah and the suburbs were not available before that date. The rise of the cholera death-rate in Calcutta, has been contemporaneous with scarcity of water, foul drainage, and inefficient conservancy. I give a description of one of the bustecs, taken from a report of mine last year as being a good example of a nursery ground for cholera.

"Previous History of Cholera in Banomaly Sircar's Bustee.—From 1876 to 1880, there were 46 cholera deaths, or an average of 9 per annum.

“During 1881-1885, there were 114 cholera deaths, or an average of 22 per annum. In 1886 there were 15 deaths. The second period of five years was thus distinguished by an increase of 148 per cent, or nearly  $2\frac{1}{2}$  times the mortality of the first period. This bustee has not a very large population, and there have been no great changes in either the class of population or numbers during the 11 years under consideration. It is apparent, however, that the inhabitants are more subject and prone to cholera within the last six years than formerly. In 1878 the bustee was to a certain extent improved, the owner having constructed a main road and several side roads through the more crowded parts. At the same time underground drains were laid down connected with gully pits situated at the side of the narrow road, also with other gully pits which are sometimes inside the confined compounds of the huts themselves. In addition to these changes, a water supply pipe was carried into the bustee in October, 1884, and a stand post erected in the main road near the centre of the bustee. Notwithstanding these improvements, cholera prevailed very severely. The deaths in the different years have been as follows:—

" SECOND PERIOD.										No. of Deaths	
" Years.											
1881,	.	.	.	.	.	.	.	.	.	.	27
1882,	.	.	.	.	.	.	.	.	.	.	27
1883,	.	.	.	.	.	.	.	.	.	.	17
1884,	.	.	.	.	.	.	.	.	.	.	34
1885,	.	.	.	.	.	.	.	.	.	.	9
1886,	.	.	.	.	.	.	.	.	.	.	15
" Total,										.	129

For a year after the introduction of the drainage and other improvements there was a slight decrease in the cholera mortality, but in the following years that improvement changed into a deterioration worse than had existed before any alterations were made, until in 1884, when seasonal conditions were favourable to cholera, 34 deaths occurred in this small bustee, 27 of these in the first half of the year. In one quarter the cholera death-rate reached nearly 80 per 1,000 per annum of the population. After this outburst a water-pipe was laid down. In 1885 there were only 9 deaths, but in 1886 the mortality rose to 15, the greatest number occurring in the fourth quarter of the year. This latter outburst led me to inspect the locality. On entering the bustee the first thing that struck me was the foulness of the air—a most offensive sewer odour was experienced; the atmosphere was thoroughly impregnated with gases proceeding from the drains and gully pits. I had the underground drains opened and exposed to view for thorough examination. They were found to be choked with filth, emitting fœtid, noisome, nauseating effluvia. Portions of the drains were completely blocked up, the contents escaping into the soil, polluting the subsoil and underground water, on which the numerous wells in the village depend for their supply of water for domestic purposes. In addition to this, the water which had been led into the bustee in 1884 could not be said to have been of any great advantage, for in consequence of want of pressure and scarcity in the locality, the supply was extremely scanty. With reference to the scanty supply of water, the following extract from my report for the fourth quarter of 1886 describes the water famine, not only in this bustee, but also in other localities:—

"I would particularly direct attention to this scarcity of water in the parts affected. Go almost where one may in the north part of the town, and especially in the riparian wards, there is the same complaint of want of water, and a very valid one it is. It is a common occurrence to see the people grouped round one of the stand posts waiting their turn to fill their

chatties; many of them to be disappointed, for the water from the stand posts often comes in mere dribblets, and the supply is exhausted or turned off before half the people are supplied. In Coimartooly district, where cholera has been very severe, I have myself seen a small chattie which contains about two gallons take a quarter of an hour to fill. That the supply of water in these localities, or in particular parts of these localities, is a diminishing quantity, is evidenced by the fact that the taps used to be four and five feet above the ground; gradually they have had to be lowered, until many people have had to sink wells in their premises, and receive the water from the tap at the same level as the pipe is laid in the ground. Scarcity of water brings in its train a great deal of sickness apart from cholera. The districts which have suffered most from scarcity of water have suffered also from a large amount of sickness, more particularly of a dysenteric character. The cholera appears to have been preceded by a period of dysenteric prevalence.

"This water famine, as I shall afterwards show, has apparently supervened gradually within the last few years. Previously, although hydrant water had not been carried into the bustee, there was water to be had in the streets adjoining. The Sanitary condition of the bustee was worse after the alterations than before. The bustee before 1879 was in a crowded and filthy state, with wells in nearly every hut, but with plenty of pure water on the outskirts of the bustee, which the inhabitants resorted to. A certain amount of cholera prevailed in the bustee, attributable to its insanitary condition and the use of polluted well water. Some narrow roads were afterwards constructed, which helped in a measure to ventilate the bustee and purify the air; then the underground drainage was extended. This, after completion, is neither flushed nor cleaned, but left to take care of itself; consequently, in a short time, the drainage becomes a seething cesspool of decomposing filth, which, escaping from the pipes, finds its way into the soil and the underground water, and creates a stinking atmosphere. About the same time the pressure of hydrant water becomes less, and gradually the plentiful supply formerly obtained from the neighbouring streets is unobtainable. Even though a pipe is placed in the bustee, the inhabitants are compelled to fetch most of their water from the river, and to use more and more the water from their polluted wells."

The remedies for the condition of affairs which I have described in this paper are simple enough, but they need time and cost much money. The first consideration is a liberal



water supply for Howrah and the suburbs and a more liberal supply for Calcutta. Few will drink polluted water if they can obtain pure water. By specially constructed tanks, even the habits of the people can be so directed as to permit them to enjoy to their hearts' content the luxury of the bath, and to perform their ablutions without danger. After this, well planned streets, allowing of free ventilation, with good building regulations, a system of drainage to pass through those streets; systematic clearing, levelling, paving, and filling up of ponds; draining, scavenging, removal of nuisances, and a well organised sanitary department will, I am persuaded, ultimately convert Calcutta, Howrah, and the suburbs, containing nearly 800,000 inhabitants, into as healthy a locality as any in the world, so far as the prevalence of diseases not due directly to a subtropical climate is concerned; and I am equally persuaded that those measures of sanitation will change one of the most important centres in the endemic area of cholera into an area no longer marked by endemicity.

In the discussion which followed the reading of the paper—*Surgeon-Major Robert Pringle, M.D.*, late Sanitary Department, H.M.'s Bengal Army, drew attention to the same subject in a paper held as read. Here we must use Dr. Pringle's own words, so that no errors may arise:—"The water supply for the traveller in India, be he European or native, was a standing disgrace to our sanitary administration in that country. Not only was little or nothing done to procure and secure a good water supply for the water drinking nationalities of India, but the most ordinary precautions were neglected, and the wonder is that, with the increased facilities for travel in India, there is not a greater amount of sickness than there is. Nor was this state of things confined to the water supply of the native population; the neglect under this head in military cantonments and civil stations was simply inexplicable." The charges which Dr. Pringle brought against the Sanitary Department consisted in their continued neglect of the most ordinary precautions, and taking his old sanitary circle in the North-West Provinces of India—namely, the upper portions of the Doab or Mesopotamia of the Ganges and Jumna, with a large hill station like Chuekrata, a convalescent depot like Landour, military cantonments like Roorkee, Meerut, Muttra, Agra, and Futtehghur—he boldly challenged the Sanitary Department to show where it had done anything to improve the water supply either in these cantonments or the large native cities attached to them.

*The President* expressed a hope that Dr. Farquharson would call attention to this important subject from his place in Parliament.

*Dr. Farquharson, M.P.*, said he would endeavour to find an opportunity of doing so during the discussion on the Indian Budget.

*Surgeon-Major Harvey* confirmed every word of Dr. Simpson in regard to the condition of Calcutta. It was a standing menace to the health of the world. Rightly or wrongly, continental nations believed that the epidemics of cholera that visited Europe were brought from India by the selfishness of the English Government, and until a remedy was provided this reproach would be brought against us by other nations. Wherever in India there were good sanitary arrangements cholera disappeared. But in Calcutta the people drank water which had been described as twice as bad as London sewage.



